MARKS POLARIZED CORPORATION
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WHITESTONE, LONG ISLAND, NEW YORK 11357

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Mr. T. Nelson
Syst. Consultant
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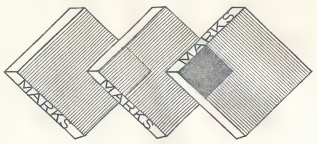



Trademark

MARKS POLARIZED CORPORATION

153-16 10TH AVENUE · WHITESTONE, N.Y. 11357 · (212) 445-9600

November 27, 1968

Mr. T. Nelson
Syst. Consultant
Box 3
Schooleys Mtn., New Jersey 07870

Dear Mr. Nelson:

In response to your request at the Society for Information Display Symposium, we are enclosing the following information:

1. "Varad" with price list
2. "Cinetron"
3. "3-Depix"
4. "Spredlite"
5. "Infropake"
6. "Marks Polarizing Material".

Very truly yours,

MARKS POLARIZED CORPORATION

Alvin M. Marks
President

AMM:ljb
Enclosures: As listed

For additional information, contact:

Director of marketing
MARKS POLARIZED CORPORATION
153-16 Tenth Avenue
Whitestone, New York 11357
212 - 445-9600

U.S. Patent Nos. 2,952,182
3,006,241
3,248,165

# CINETRON
# CINETRON
# CINETRON
# CINETRON

# CINETRON

## DEPTH WITHOUT GLASSES - SYSTEM DEVELOPED

by

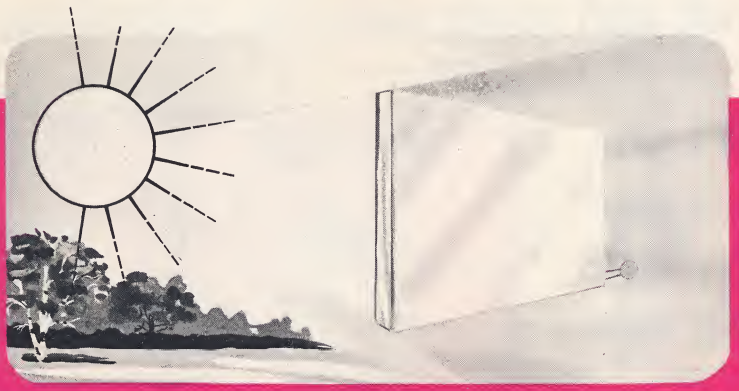
MARKS POLARIZED CORPORATION
153-16 Tenth Avenue
Whitestone, New York 11357

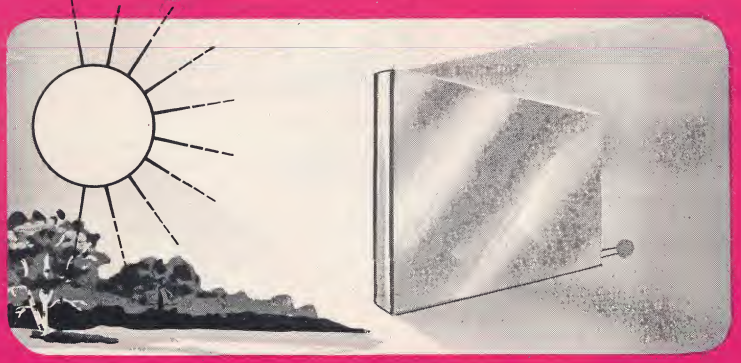
The desire of adding depth to a slide or a Motion Picture show has long been a goal of the film industry. There are a number of systems in use today; some use stereo projection with colored or polarized glasses, others use lenticular screens to sort out the stereo pairs without glasses. The latter system is limited to a small screen viewed near the display. Systems using glasses involve projection and viewing stereo pairs which in turn produce depth. Only Cinetron uses two projection planes, each with its own picture coordinated to produce a depth feeling with an actual depth cue, which may be viewed without distortion and at any point in the theatre without glasses.

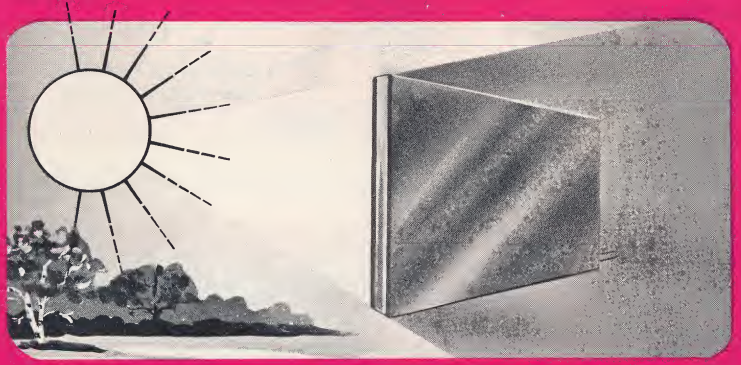
Cinetron utilizes foreground and background information projected from the front and rear simultaneously. Between the screens a filter is inserted, so that the pictures projected onto the front screen are not imaged on the back screen, but the rear picture can be readily viewed through the front screen, which is perforated to approximately 50% open spacing.

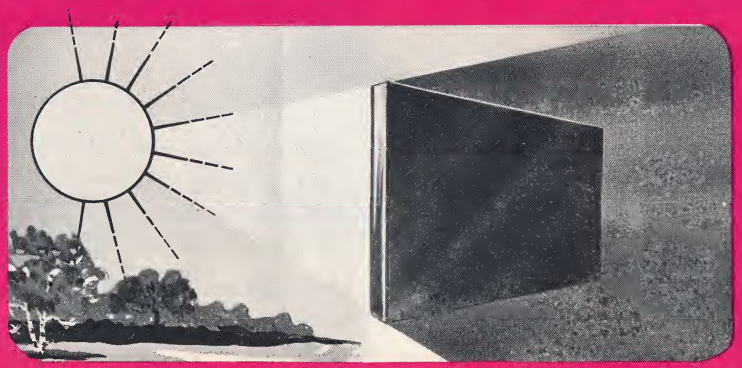
With some practice, unusual combinations of foreground and background pictures may be combined to produce an exciting display with a real feeling of depth. Cinetron adds the extra touch of realism that is entertaining and will create a new excitement.

# VARAD™









## ELECTRO-OPTICAL LIGHT CONTROL

**a new concept in controlling light utilizing glass or other transparent materials**

MARKS POLARIZED CORPORATION • WHITESTONE 57, NEW YORK

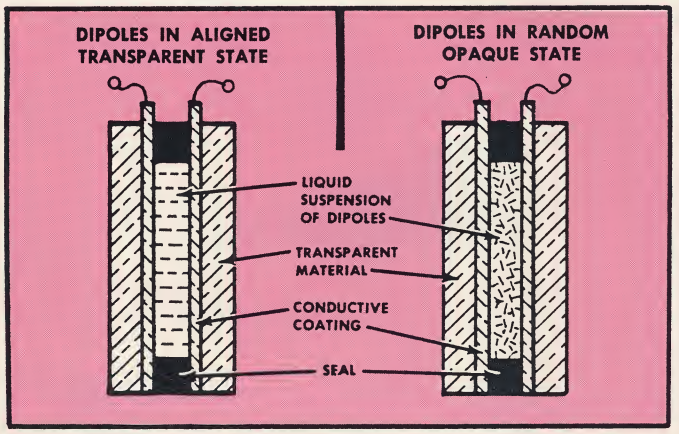
# 'Marks' is first again in Elec

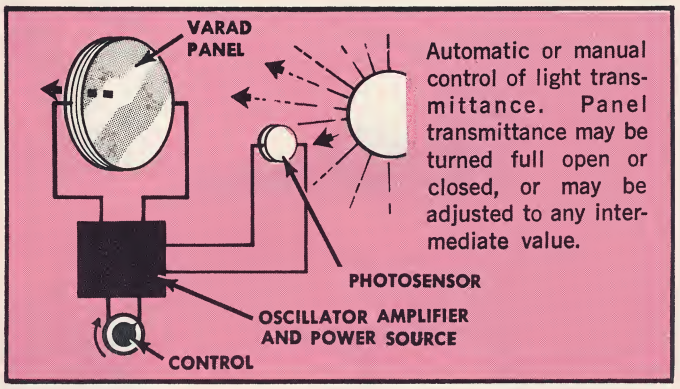
for use in goggles and visors, camera shutters, 2-D or 3-D electronic displays, variable transmittance window panels, advertising displays, aircraft and space vehicles, recording media

## what VARAD is . . .

**The intensity of transmitted light can now be controlled by a variable density electro-optical material known as VARAD. VARAD has the capability for VAriable transmittance, absorbance, and/or reflectance of light RADiation in response to an electric field.**

**Structurally, it consists of two outer layers of glass (or other transparent material such as plexiglass or other plastic, etc.), each of which contains a transparent electrically-conductive coating laminated to its inner surface. Between the laminations is a sealed-in liquid layer containing dipoles in suspension. When a voltage difference is applied to the conductive coatings on each side of the liquid layer, the dipoles — submicroscopic needle-like particles capable of interacting with light — align at right angles to the glass sheets, more or less parallel with the light rays. Upon removal of the electric field, the directions of the dipoles become random as a result of thermal molecular impacts. When distributed by random, the dipoles reduce transmission.**




Automatic or manual control of light transmittance. Panel transmittance may be turned full open or closed, or may be adjusted to any intermediate value.

## PRESENT APPLICATIONS

Present VARAD applications are broad in scope with immediate usage practical in fields shown at right:

**PHOTOGRAPHY:** Combined variable density filter and non-mechanical electro-optical shutter.

# tro Optics VARAD – a window which controls light

## CHARACTERISTICS

| | |
|---|---|
| **Shape** | Manufactured flat, spherical, cylindrical, square, rectangular, etc. |
| **Thickness** | Determined by panel size with thickness ranging from 2 millimeters for 1 centimeter (0.40″) diameter to approximately 15 millimeters for 60 centimeters (24″) diameter. |
| **Size** | Presently available in sizes from 1 centimeter (0.40″) to 60 centimeters (24″). |
| **Opening Time** | 100 microseconds to 1/e. |
| **Closing Time** | 5 milliseconds to 1/e (or less with use of crossed electric field). |
| **Temperature Stability** | Most service conditions are being satisfied. Limits presently being established. |
| **Voltage & Current Requirements** | The voltage required is 400 volts RMS. The current per unit area is 0.27 ma/cm². The current is substantially 90 degrees out of phase with the voltage. Therefore, negligible power is required because the load is essentially capacitive and of nearly infinite resistance. |
| **Electrodichroic Ratio** | Defined as the ratio of optical density closed (Dc) to optical density open (Do) at a given applied voltage. The ratio is directly proportional to the applied voltage. For a VARAD panel using 400 volts at 25 KC, an electrodichroic ratio of 15 is obtained. The upper and lower ranges of transmittance (depending on dipole layer thickness), for this ratio of 15, are:<br>63% open, 0.1% closed<br>(Do = 0.2) (Dc = 3)<br>50% open, 0.0013% closed<br>(Do = 0.3) (Dc = 4.5)<br>31.5% open, 1.3 x $10^{-5}$ % closed<br>(Do = 0.5) (Dc = 7.5) |

## FEATURES

Variable Transmittivity ● High System Reliability — No Moving Mechanical Components ● Low Power Consumption — Microwatts Per Square Foot of Panel Area ● Operates on AC or DC Power ● System Simplicity — Low Fabrication and Maintenance Costs ● Lightweight and Compact ● Environmentally Stable.

## ITS FUTURE

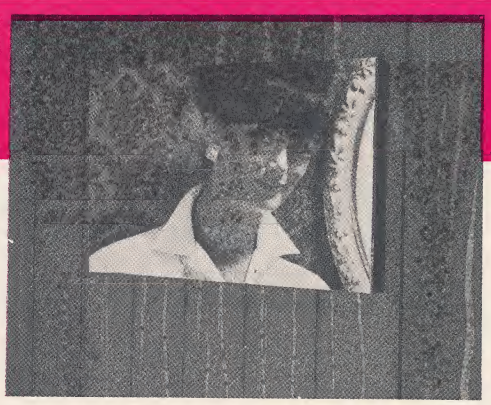
Several immediate VARAD applications have already been licensed. MARKS is continuing its research and development to improve VARAD still further. For example, the characteristics listed herein are those for a particular dipole suspension. Improvement of these characteristics and the state-of-the-art is continually being sought. In addition, potential VARAD applications are being researched for the following fields:

1. **PHOTOGRAPHY**
   - a. Dynamic Masks
   - b. Controlled Contrast
   - c. Photographic and Photocopy Paper
   - d. Instantaneous Pictures
2. **ELECTRONIC DISPLAYS**
   - a. 2-D and 3-D TV and Radar Displays
   - b. Blocking Screens
   - c. Light Amplifiers
3. **ADVERTISING DISPLAYS**
4. **AIRCRAFT AND SPACE VEHICLES**
   - a. Internal Temperature Control
5. **PIGMENTS**
   - a. Color; Polarized; Non-Fading
6. **COPY PAPER**

Investigation of applications for your area of interest may prove a profitable one. We at MARKS invite your inquiries and, upon request, we will be happy to consult with you about fulfilling your requirements. VARAD panels, power packs and accessories are for sale and special quotations will be made for particular applications.

**GLES AND VISORS:** Variable transance eyeglasses or goggles providing matic light intensity control from sun-; flash protection from nuclear and r type explosions; arc welding; etc.

**BUILDING WINDOW AND WALL PANELS:** Windows which control light transmittance without use of shades or blinds; wall panels which control building temperature.



**ELECTRONIC DISPLAYS:** Flat picture-on-the-wall television display panels to replace present conically shaped television tubes; also, advertising displays.

# OTHER MARKS DEVELOPMENTS

## IN PRODUCTION

| | |
|---|---|
| LINEAR AND CIRCULAR POLARIZERS | Suitable for innumerable military and civilian purposes—advertising displays, instrument panels, filters, theatrical effects, sunglasses, (regular and prescription) used to reduce glare and reflection; and for light control. (Available in sheet plastic and laminated glass.) |
| MICRO LAMINATIONS | A strain-free laminated glass or plastic micro-lamination, with controlled thickness starting with .0015 inch, 100% transparent, or matching any desired spectro-photometric curve. The lamination withstands grinding and polishing and can be handled like solid material. |
| TRANSPARENT CONDUCTORS | A transparent electrical conducting film or laminate with 100% light transmission (less 8% surface reflection). |
| HARD SURFACE COATING | A transparent hard surface coating which may be applied to protect softer plastics. |
| VADO (Variable Density Optical Device) | A transparent film which darkens when exposed to light and returns to transparency when light is removed. Suitable for use on windows, sunglasses, goggles. |

## UNDER DEVELOPMENT

| | |
|---|---|
| 3-DIMENSIONAL ELECTRONIC OPTICAL RANGING SYSTEM | Solid image 3-D device. In a typical use, a given volume of space can be viewed inside a transparent cube with all objects displayed in 3D. Suitable for air traffic control, radar surveillance. |
| 2-DIMENSIONAL PICTURE-ON-THE-WALL TELEVISION DISPLAY | A flat panel either self-luminous or reflective containing printed scanning circuits and utilizing VARAD dipolar electro-optical principles. |
| DIMENSION MOVIE SYSTEM | An optical projection system utilizing two special screens for motion picture theatres for presenting foreground and background pictures simultaneously giving a three-dimensional effect. |
| CRYSTAL GROWTH PROCESS | A rapid and economic process for growing crystals in thin sheets or mass boules directly from solution. |
| HEAT POWER GENERATION | A device which directly converts heat into electrical energy through the medium of charged aerosols. |

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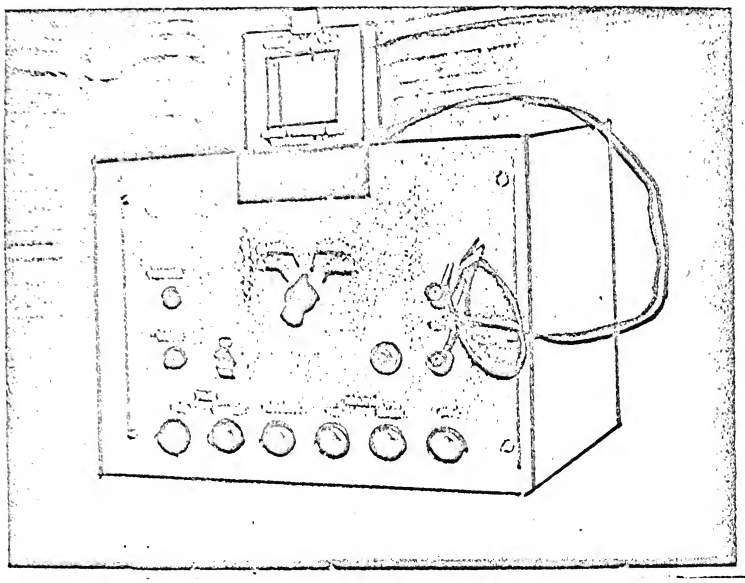
# VARAD™



VS-3 VARAD Cell and VP-3 Power Supply shown with various controls, including amplitude, frequency, light modulation, photocell, output

| VARAD CELL SQUARES OR CIRCLES | | | | | POWER PACK | |
|---|---|---|---|---|---|---|
| Cat. No. | Outside Dimensions | Inside Dimensions | Thick-ness | Price | Cat. No. | Price |
| VS-1 | 1" x 1" | 1/2" x 1/2" | 1/4" | $ 250 | VP-3 | $ 550 |
| VS-3 | 3" x 3" | 2" x 2" | 3/8" | $ 250 | VP-3 | $ 550 |
| VS-4 | 4" x 4" | 3" x 3" | 3/8" | $ 500 | VP-4 | $ 875 |
| VS-6 | 6" x 6" | 5" x 5" | 3/8" | $1185 | VP-4 | $ 875 |
| VS-12 | 12" x 12" | 11" x 11" | 1/2" | $2500 | VP-4 | $ 875 |
| VS-24 | 24" x 24" | 22" x 22" | 5/8" | $5000 | VP-5 | $1200 |

The sizes listed are standard catalogue items. Special requirements as to shape, overall area, ative area and thickness can be met on special order.

ΔSpecial quotations will be made for quantities or specifications different than the standard product. The basic Power Pack consists of a voltage source, amplifier, oscillator and controls to vary frequency and voltage. It operates on 110-120 volts 60 cycle AC. The cabinet size is 8" x 8" x 12". The Power Pack operates at 7000 to 20,000 KC modulated voltage specially-timed circuits for the Varad Cell. We recommend that you use our Power Pack for your initial investigations.

Photocell Accessory VP-1 for controlling transmittance - $75.00.

Varad Dipole Solution No.100

| | |
|---|---|
| 10 grams $5.00/gram | $ 50.00 |
| 100 grams 3.00/gram | $ 300.00 |
| 500 grams 2.00/gram | $1000.00 |

ΔFOB Whitestone, N. Y. 11357


## MARKS POLARIZED CORPORATION

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# AN ELECTRO OPTIC LABORATORY WITH THE VARAD ELECTRONIC ACTUATOR AND THE VARAD CELL

Now you can utilize the VARAD panel to perform many electro optic control functions = all conveniently assembled in one electronic package.

At the turn of the selector switch - obtain a range of electronic control for electro optic devices:

| MODE | CONTROL | | |
|---|---|---|---|
| | ACTUATION | SELECTOR SWITCH | OTHER |
| NORMALLY DARK | PHOTO ELECTRIC | 1 | C |
| NORMALLY CLEAR | PHOTO ELECTRIC | 2 | C |
| SINGLE PULSE | TRIGGER INTERNAL | 5 | B,C,E |
| SINGLE PULSE | TRIGGER EXTERNAL | 5 | B,C,F |
| ON - OFF | MANUAL INTERNAL | 6 | B,C,E |
| ON - OFF | MANUAL EXTERNAL | 6 | B,C,F |
| CONTINUOUS | | 3 | C,B |
| | MULTIPLE PULSES | 4 | A,B,C |

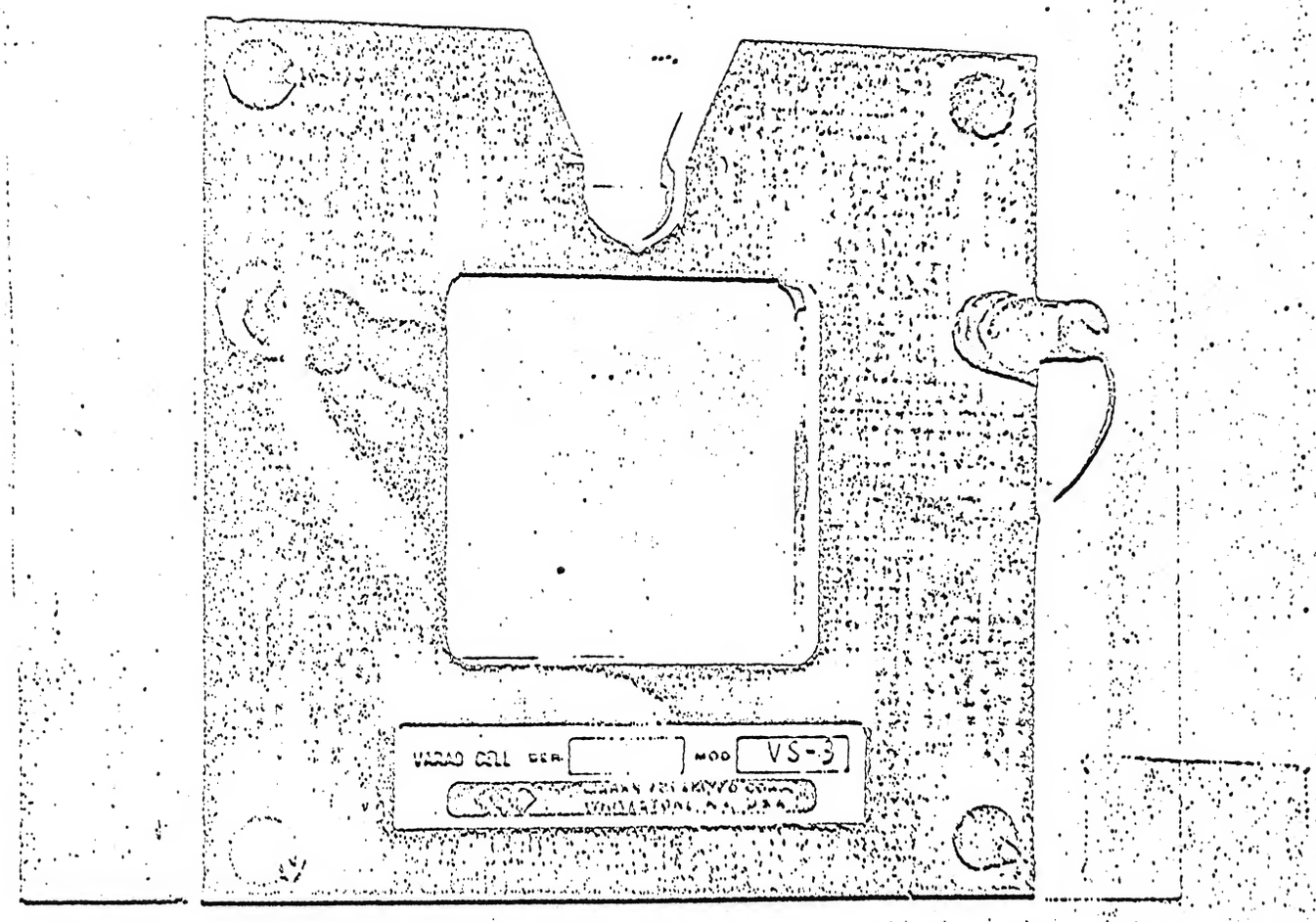
CONTROLS

A - Control knob for pulse repetition rate - 1-1000 H2
B - Control knob for pulse width - 1 to $10^{-3}$
C - Control knob for Voltage Amplitude - 0-1500 volts rms
D - Control knob for Frequency - $10^{2}$ - $10^{5}$ H2
E - Push Button Switch - Manual Conrol on Panel
F - Jack for External Push Button Switch

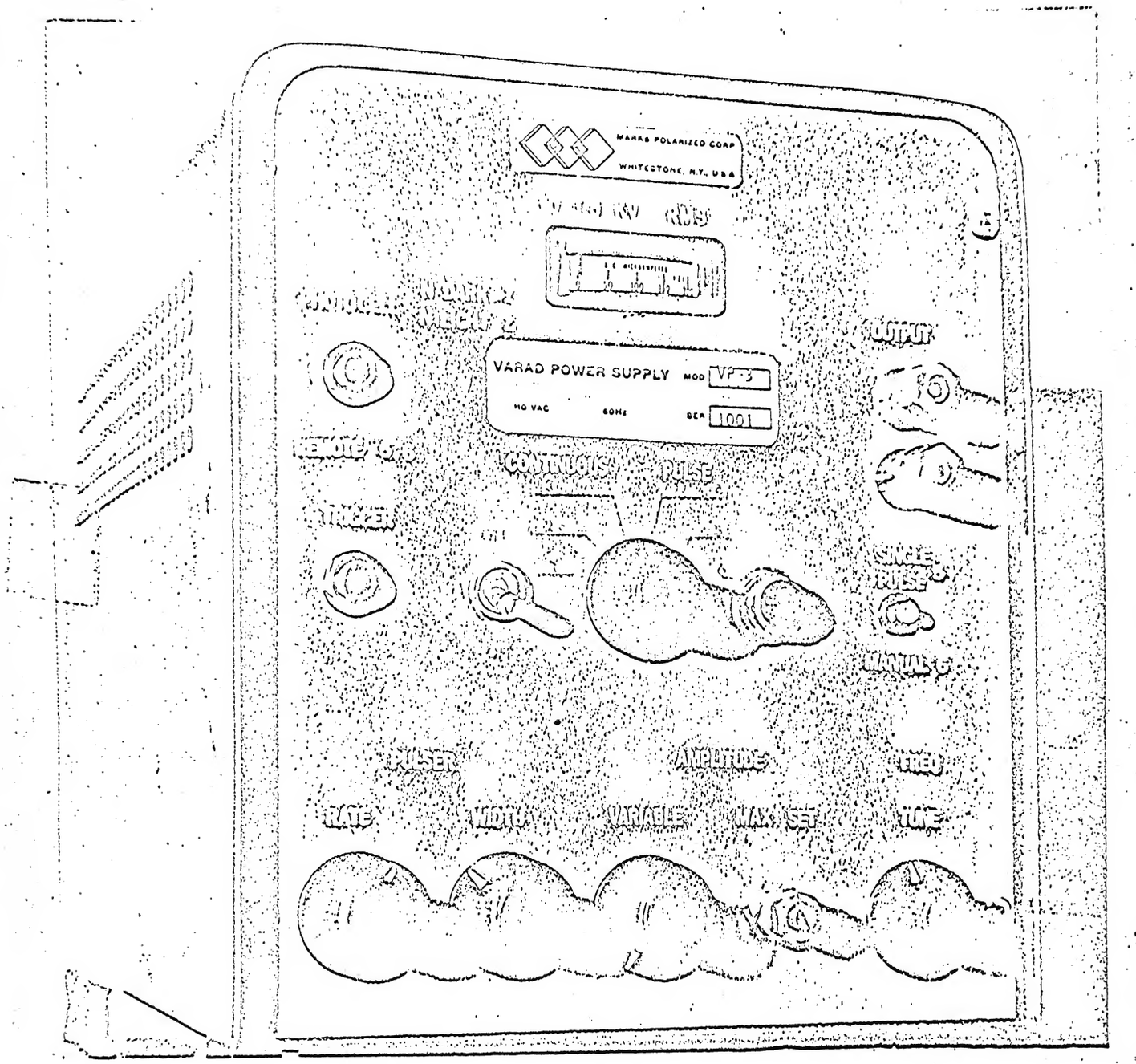
Catalogue No. - VP-3
Weight unpacked - 7.9 Kg (17.4 lbs.) Dimensions 12"x9 3/4"x8 3/16"
PRICE - $550.00 - F.O.B. Whitestone

Order from:
MARKS POLARIZED CORPORATION
153-16 10th Avenue, Whitestone, New York 11357

(212) 445-9600


VS-3

# VARAD ELECTRONIC ACTUATOR VP-3




WEIGHT UNPACKED - 7.9 Kg (17.4 lbs)
WEIGHT PACKED - 10 Kg ( 22 lbs)
DIMENSIONS OF VP-[3] :12"x 9 3/4x 8 3/16"
PRICE $550.00 -F.O.B. WHITESTONE,LIN.Y.

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# CINETRON

## APPARENT 3-DIMENSIONAL PICTURES WITHOUT GLASSES

-by-

Alvin M. Marks

Paper Presented at the Society for Information Display Symposium, Waldorf Astoria Hotel, New York, New York, on November 25, 1968.

Marks Polarized Corporation
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212-445-9600

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ABSTRACT

A two-screen display system is described, whereby a foreground scene and background scene are displayed as two images separated in space. The image displacement results in two plane 3-D, which the audience views without glasses.

# CINETRON

## APPARENT 3-DIMENSIONAL PICTURES WITHOUT GLASSES

1. INTRODUCTION:

Since the advent in 1953 of a 3-D motion picture system which used polarized glasses, a way has been sought to produce a 3-dimensional effect without the use of glasses.

In the 3-D system used by the movie industry in 1953, stereo pairs, i.e., pictures photographed from different angles, were projected simultaneously onto a matellized screen through polarizing filters oriented at right angles to each other, and an associated pair of polarizing spectacles is worn by the viewer. Each eye of the viewer thus sees only one of the projected images which are then combined by the brain into a single image with apparent depth.

This system of stereoscopic projection, which is commonly known as "3-D", has the disadvantage that the viewers must wear special spectacles.

In another system, the ratio of reflecting screen width was increased relative to the screen height, to have a picture area which more nearly corresponds with the normal visual field of the viewer, which is about 3 to 1. Such screens are usually curved to create a certain amount of depth by providing more peripheral vision.

It is impossible, using wide screens, to create as much apparent depth as with the "3-D" system using glasses.

The system described in this paper is known by the trademark CINETRON, developed by the Marks Polarized Corporation, of Whitestone, New York 11357, U.S.A.

The CINETRON system creates an apparent depth effect comparable to that created in the stereo systems but one not requiring the use of spectacles by the viewer. It is adaptable to any size screen, and may be viewed from any vantage point within a theater while still gaining a full three-dimensional effect. Any theater adapted for the CINETRON system will also be able to show conventional films. It can be readily installed without great expense in most theaters now in use.

The CINETRON 3-D system is a revolutionary concept of motion picture entertainment.

The CINETRON system is well adapted to the projection of slides in depth for industrial, advertising, education and entertainment purposes.

## 2. THEORY

In this system a pair (or more) of related images is projected onto an associated pair (or more) of spaced reflecting screens along a viewing axis such that the multiple images are visible to the viewer as an apparent single image having depth characteristics.

The psychology and physiology of normal three dimensional vision remains for all practical purposes an undeveloped science at the present time. It is known that the horizontal spacing of the eyes contributed to natural three dimensional viewing but mathematically it can be demonstrated that this spacing has a relatively negligible effect beyond a short distance from the eyes so that other factors must be involved. The stereo systems use this principle, however, and may exaggerate this condition causing eye strain. It is known that perspective, high-lighting or shadowing of the image, motion or peripheral vision contribute to the sense of depth, in addition to the relative displacement of spaced images previously discussed. The present system permits stereo pairs to be produced naturally without eye strain from images formed on spaced planes which taken together with other natural cues of depth produces an apparent three dimensional image in space without the use of glasses, with non-critical viewing from all angles throughout the theater.

The director of a movie or slide show produced according to the CINETRON process may use any of these factors and techniques to obtain depth using skill and artistic composition.

2.1 Composition

The images are related generally in the sense that the image on the screen closest the audience is a foreground image whereas the image on the screen farthest from the audience is a background image. As a general rule the foreground image will include only that part of the picture which contains the foreground elements being photographed, whereas the background image contains only that portion of the picture which contains the background elements.

The actual spacing of the pair of reflected images creates a depth quality to the picture as viewed.

The depth effect is emphasized because background and foreground images are displaced relatively as seen by each eye. The alignment of the two spaced images is seen at a different angle by each eye which creates different images in each eye very similar to stereo pairs.

If the viewer moves his head from side to side, the foreground objects appear to move relative to the background objects in the same manner that near objects appear to move relative to distant objects in normal viewing when the head is so moved. If the viewer moves laterally in the theater he sees behind the foreground image as though it were a solid object on the front screen, and views part of the scene on the rear screen previously blocked by the image on the front screen.

This is also true, of course, in natural vision. This is not true in any single plane movie projection system, however, there is a similar illusory effect with a pair of polarized stereo images on the screen and a pair of polarized spectacles on the viewer.

The composition of the foreground and background images is one of artistic choice, subject only to the necessary rules for placement of foreground and background images on the appropriately spaced screens. Each image on each plane has its own inherent perspective, high-lighting and other depth cues, which must be suitably combined to give the whole ensemble an illusion of a complete scene with depth characteristics.

The background image such as empty room or outdoor scenery, etc., is photographed on movie film strip or slide. The foreground image is separately photographed on another movie film strip or slide. The foreground subject may comprise action taken in a plane in front of the background, in which all background objects are removed or otherwise blacked out. The material covered in the foreground picture is generally not to appear in the background picture, and vice versa. The background can be eliminated in the foreground picture by a black curtain at the plane of division, by blacking out portions of the background image, or any other

methods known to the photographic art.

2.2 Distance Between Screens

The distance between foreground and background screens may vary from zero to several screen heights, and this distance may be controlled to obtain a variety of effects. However, in most cases a suitable fixed distance may be employed between the two screens, equal to about two-thirds of the height of the picture.

2.3 Curvature of Screens

The foreground and background screens may be straight, and generally parallel to each other; or curved, with greater curvature in the rear screen so that the ends of each screen tend to meet at the picture edge to form a meniscus as viewed on a horizontal section. Any combination of spaced screens may be employed, a curved pair may be parallel, or a curved screen may be used with a straight screen, etc.

If the screens remain widely separated at the edges, the viewers at widely divergent angles will tend to see a dark edge along the side of the rear screen opposite from the viewer's position. The meniscus is preferred since it will result in a defined picture edge to those viewers sitting at widely divergent angles. An infinite number of separated "planes" may thus be attained at different

portions of the screen ranging from the widest separation at the center to no separation at the edges. This is particularly valuable since greater depth is usually required at the center of the scene and lesser depth at the sides, because of the decreased peripheral resolution.

## 2.4 Light Intensity and Color

The light intensities and color composition must be controlled on the foreground and background images to avoid conflict between the foreground and background images.

### 2.4.1 Light Intensity

When the contrast is high in the foreground image, its intensity should be at least five times that of the background image. At areas where the background image is bright, e.g., a bright cloud, airplane, ceiling, etc., the foreground image should not appear at all, that is little or no light should be projected on the foreground screen where the background images are bright and of high contrast. The intensity is adjusted for the picture composition on the foreground and background films.

The relative intensities of the two reflected images may be controlled by light filters, both polarizing and non-polarizing, varying the relative intensities of the modified reflecting screens, and adjustment of light intensities at the foreground and background projection sources.

2.4.2 Color

Colors having the greatest visibility lie near the middle of the visible spectrum, and colors of lesser visibility lie at both ends of the spectrum. The colors ranging from about 4900 to 6000 Å units and white appear to advantage on the front screen, whereas the visible colors on either side of this range appear to advantage on the rear screen. White, high contrast pictures, and those colors known to produce the greatest visibility response by the human eye, namely, yellow, green, orange and combinations of these with white light, when projected as images on the foreground screen, will generally mask colors with lesser visible response by the eye such as violet, deep blue, deep red, and the darker shades of green and orange. Colors having lesser visible response should appear on the background screen where they will be more readily masked by foreground images of greater color visibility, which will then appear solid.

2.5 Overlap of Images

Where different images of high contrast, high intensity, highly visible colors, are to appear simultaneously on both background and foreground screens, care must be taken so that they do not overlap from any angle of view in the audience. This requires that there be a minimum distance separating the two objects laterally and vertically regardless of the depth separation. Where there

is sufficient separation there is no requirement for observing any particular limitations on color composition or intensity. However, where two objects of high contrast and brilliance are eventually to overlap, action can be started with objects on both screens a suitable distance apart as observed along the viewing axis and then the objects brought together on either the foreground and background screen where they may overlap on the same screen without difficulty.

2.6 Transfer of Images

Images may be transferred from one screen to the other by having the image appear on one screen as it fades from the other screen. In addition, an image may be moved on one screen to a point where both screens contact one another, and then the image may be moved away from the point of contact on the other screen, e.g., at either lateral edge when meniscus screens are used.

Action, such as the throwing of a ball from a distance toward the audience may also be portrayed effectively by starting the ball for example at an apparent 10' on the background screen and then continuing from an apparent

10' to 1' on the foreground screen. The persistence of vision effect provides continuity in the jump from the background to the foreground screen, and the distance between the screens, the perspective, and shading of the images, and the increasing size of the ball as it approaches first on the background screen, and then on the foreground screen, all cooperate to produce a realistic depth effect. The distance between screens may be controlled so that images on one screen can be moved to a second screen. The control may be a servo motor supplied by a superaudible signal on the film sound track.[4]

2.7 The Perforated Front Screen

The relative amount of reflecting area to open area may be varied and is important control of the relative intensity of the two images. The absolute size of the small individual reflecting areas and spaces is also variable but must be retained within the range where each image, if projected alone, would appear as a whole image to the audience from or through the front screen. The viewers are unable to distinguish a pattern of open areas and reflecting areas. A suitable hole size may be, for example about 1 mm., with 45-60% open area.

2.8 Synchronization of Films

A pair of projectors must be mechanically or electrically interlocked so that the related images will be synchronized.

Where both projectors are in a booth at the rear of the audience, the foreground and background images may be combined onto a single film, on successive frames, or beside each other on the same frame.

## 3. SYSTEMS DESCRIPTION

Work has been done on three modifications of the CINETRON system. Only the first system (3.1) is being offered commercially. A short description of these systems follows:

### 3.1 CINETRON Front and Rear Projection System [1,2]

Figure 1 illustrates a CINETRON screen and projection system. The front screen is a reflecting screen of standard type specially perforated to obtain the required light transmitting and light reflecting quantities. For example, such a screen may transmit about 50% and reflect about 40% of the incidental light. The back surfaces of the screen are preferably black.

The foreground picture is reflected from the front screen, and the background pictures go through the perforations on the first screen. The front screen picture is synchronized with the back screen picture.

Spaced between the front and rear screens is a neutral filter 2 which may have a transmittance of about 25%. The

filter 2 is positioned at an angle to the vertical so that unwanted front surface reflection will be reflected away from the viewer, to prevent the viewer from seeing a "ghost" image.

The rear screen 3 is generally parallel to the front screen. This screen has a special diffusing layer, to form the image projected on it. Screens used for such rear projection are well-known, for example, "Spredlite", manufactured by Marks Polarized Corporation.

As an example, a Spredlite screen transmits about 50% of the light from the rear projector 4 and reflects about 10% of the light incident from the front, both being diffused over a wide angle.

A foreground projector 5 projects a foreground image on the screen 1 and a background projector 4 projects a background image onto the rear screen 3 from behind the rear screen.

As an example, if the front screen reflects 40% and transmits 50% of light and the projection onto the front screen has an intensity of 100 lumens, the reflection back to the audience will have an intensity of 40 lumens while 50 lumens will be transmitted through the screen. The filter 2 transmits 25% of the light, hence 12.5 lumens will pass through

to strike the rear screen 3. Since the screen 3 reflects 10% of the light, 1.25 lumens will be reflected toward the audience. This passes again through filter 2 which further decreases the intensity to 0.3 lumens which on passing through the front screen 1 is further decreased to 0.15 lumens. This is practically negligible, and no visible "ghost" image results. The "ghosting", or the ratio of foreground image reflected from the front screen to the foreground image reflected from the rear screen and back through the front screen, is a ratio of 40 to 0.15, or about 270.

If the background projector projects an image of 100 lumens onto rear screen 3, 80 lumens will pass through the screen. This intensity is decreased by filter 2 to 20 lumens which is again decreased to 10 lumens by the front screen 1. Thus the intensity of the images to the viewer are 40 lumens for the foreground image and 10 lumens for the background image; or a ratio of about 4.

3.2 CINETRON Overhead Projection System [3]

Two synchronized projectors are used in a booth in the rear of the audience. One projector projects a foreground image onto a front perforated screen and reflects therefrom.

The background image from the second projector is anamorphized into a fan-shaped beam expanded by a cylindrical reflector

and reflected from the background screen as a full-sized image.

### 3.3 CINETRON Polarized System [4]

Two synchronized projectors are used in a conventional booth in the rear of the audience. Horizontal and vertical polarizers are used in front of the two projectors. The front screen is perforated and comprises a vertically polarizing layer over a diffuse metallic reflector. The back screen is a continuous surface, comprising a diffuse metallic reflector, overlaid with a horizontally polarizing layer.

The foreground image is reflected from the front screen and absorbed on the back screen. A portion of the background image is absorbed on the front screen, while another portion reflects from the back screen and is seen through the perforations.

For further information on the CINETRON, refer to the references. [1-4]

5. References:


1. Marks, Alvin M., "Method for Producing Apparent Three-Dimensional Images", U.S. Patent No. 2,952,182, September 13, 1960.

2. Marks, Alvin M., French Patent No. 1,196,308, May 22, 1958.

3. Marks, Alvin M., "Method and Apparatus for Overhead Projection", U.S. Patent No. 3,006,241, October 31, 1961.

4. Marks, Alvin M., "Moving Screen Projection System", U. S. Patent No. 3,248,165, April 26, 1966.

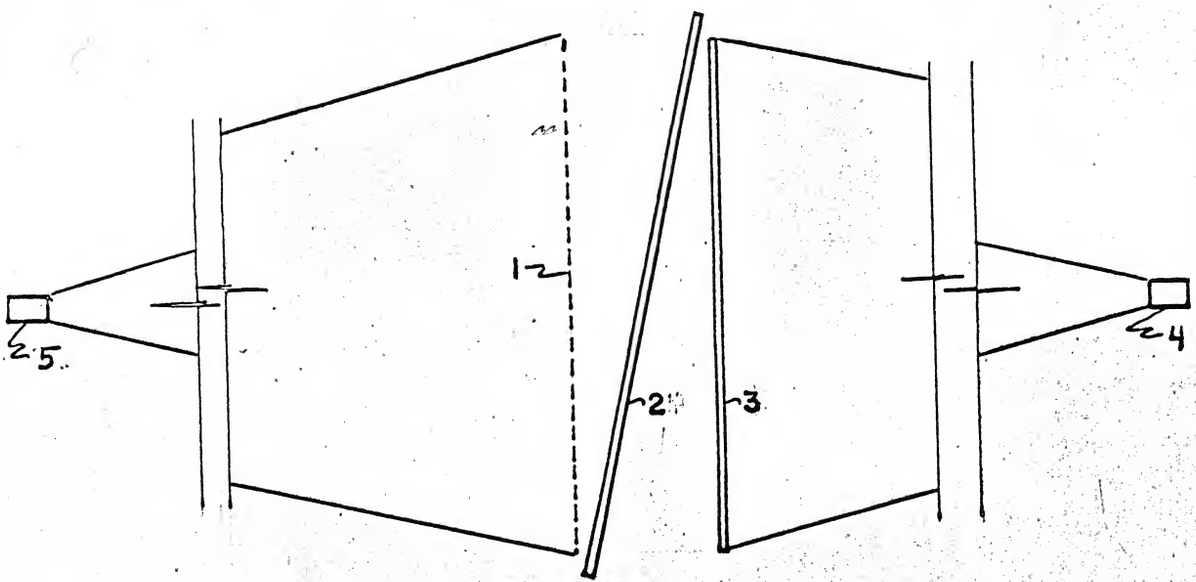
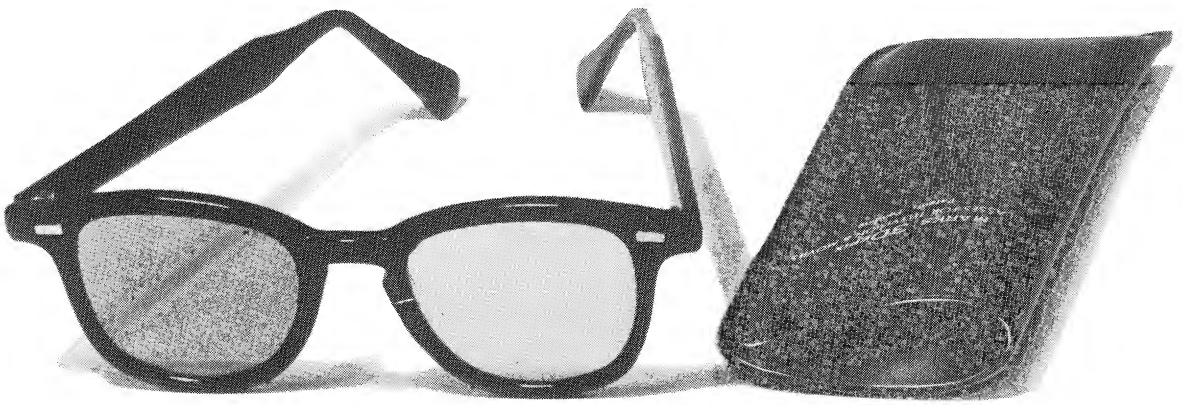



FIG. 1

# WHAT'S New?

# *TV in 3D That's what's New!*



**MARKS** *3-Depix viewing glasses produce 3-dimensional images for TV and home movies. Developed after 35 years of research, the glasses are based on a new principle of physiological optics. Glasses come in regular or clip-on versions, cost $9.95.*

HOME MOVIE FANS and television viewing fiends take notice! If your home movies are suffering from a lack of visual excitement, or your TV programs have lost their usual fascination, you *can* do something about it. The "something" in this case stems from an unusual instrument which utilizes physiological optics. Physiological optics being the human eye.

It has been known, and amply demonstrated, for many years that the effect of depth perception, or three-dimensional viewing, stems from the eyes seeing two images—slightly displaced—of a subject being viewed. Stereo cameras work on this principle. But it has also been demonstrated that a two-dimensional image can be made to appear three-dimensional by utilizing the "Pulfrich Effect."

To demonstrate the "Pulfrich Effect," you merely have to hold a neutral density filter over one eye and view a moving image (on a TV screen, motion picture, or home movie screen). The filter covering one eye delays the visual image for a fraction of a second, whereas the uncovered eye receives the visual image almost at once. The net result is that the brain receives two images—slightly displaced—and reconstructs them as a three-dimensional effect.

In the absence of a neutral density filter you can perform the "Pulfrich" experiment with a pair of sunglasses that has had one lens removed. This effect has been known for many

**Reprinted from April 1967 U.S. CAMERA & TRAVEL**

years. However, viewing moving figures for an extended period of time resulted in eye fatigue, and the three-dimensional effect lessened to the point where it was no longer effective.

In addition, the effect is fully noticed only when the viewer looks at moving figures — preferably moving across the line of vision. Stationary objects do not have depth, and the "Pulfrich Effect" cannot be seen when looking at a motionless scene such as an ordinary photograph. But the effect is noticeable, particularly when viewing some fast moving action such as football players, or basketball games on TV.

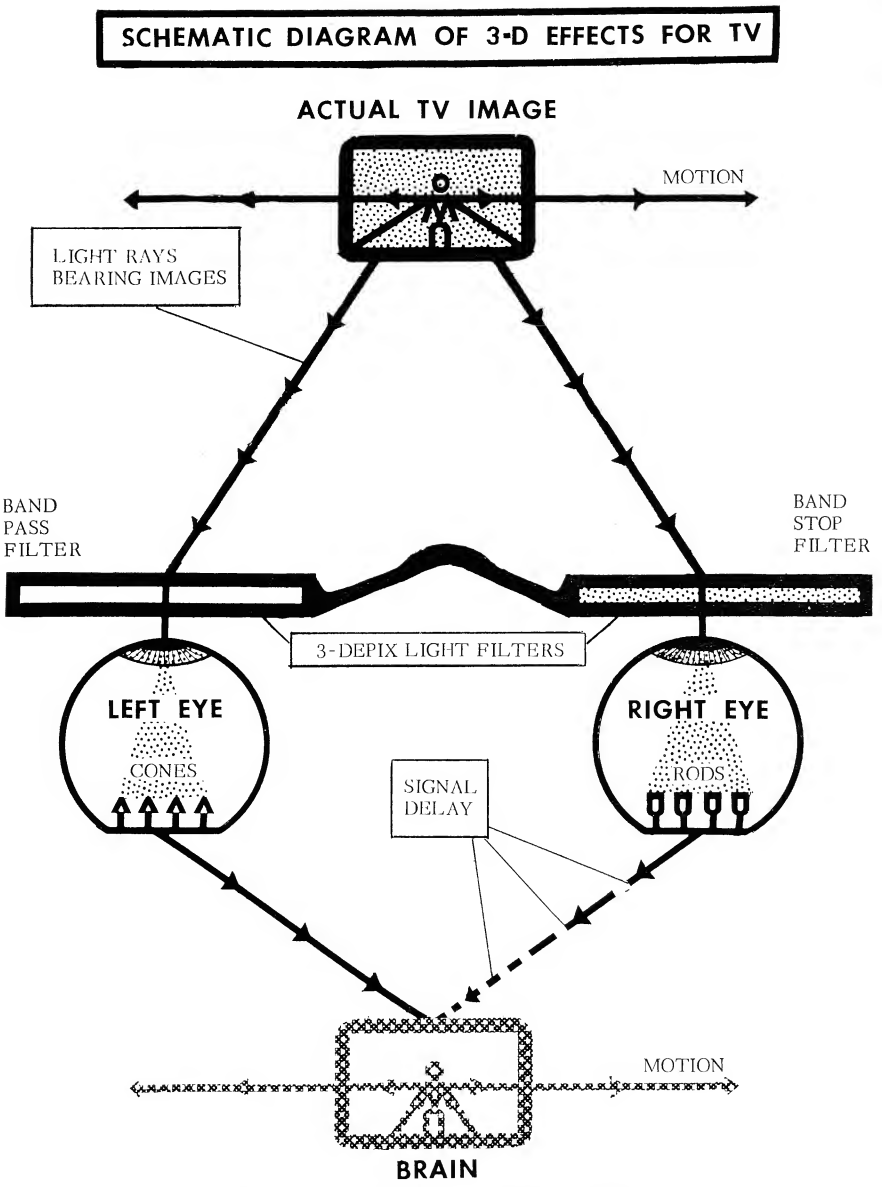
The Marks Polorized Corporation, a firm noted for unusual developments in many fields, has just concluded research on the "Pulfrich Effect" and has successfully constructed a pair of specially made viewing glasses which permits anyone with normal vision to enjoy three-dimensional television or homemovie viewing.

The glasses utilize two lenses, one tinted yellow which peaks at 560 nm (called the band pass filter), and the other being a magenta lens which has a minimum of 560 nm (called a band stop filter). When worn over the eyes the band pass filter actually activates the *cones* of the left eye, and the band stop filter activates the *rods* of the right eye. Because there is a difference in the time of reception of both eyes, a moving image on a flat TV screen will apear three-dimensional!

A look at the line drawing will illustrate how this is achieved. When wearing the glasses the viewer does not experience any discomfort or eye fatigue, and the glasses may be worn for long periods of time. However, the visual image is slightly warm in color, and viewing color TV may present a small problem. This problem can be overcome if the color set is tuned while wearing the glasses. But when viewing home movies it may be necessary to filter the image reaching the screen. I have used a mild blue filter which seems to negate the warm cast of the glasses. Naturally the blue filter is placed in front of the projection lens—not over the glasses.

The study of the physiological optics theory is fascinating, and the Marks 3-Depix glasses are equally fascinating. It is a point of interest that when tired or fatigued, the effect is less noticeable than when alert. Coffee seems to help the viewer achieve a high degree of depth perception—whereas anything such as aspirin will help to negate the full effect.

For the home-movie fan there is the option of shooting his movies with a deliberate panning motion of the camera to keep his subject in almost continuous motion, thus maintaining the 3-D effect for a long time. Home movies made and viewed in this fashion are doubly interesting, and viewer participation is always at a high when seeing something new for the first time.




The 3-Depix glasses are available from the Marks Polorized Corporation, 153-16 10th Avenue, Whitestone 57, New York. The price of a single pair of glasses is $9.95, and they are available in standard frames for those who have normal vision, and in a clip-on version for those who wear prescription glasses. In addition to the glasses you receive an interesting pendulum experiment which can be used to demostrate the "Pulfrich Effect" to its fullest.

I, for one, have been having the time of my life with these glasses, and I recommend them to anyone who is interested in the new and unusual.—*Paul R. Farber*

TECHNICAL DATA SHEET NO.700

# SPREDLITE REAR PROJECTION SCREENS

SPREDLITE Rear Projection Screens are constructed with a fine-grain coating composition deposited on glass or plexiglas, which provides unique light diffusion properties. The entire image is focused on the thin coating, which is less than .001" thick, making for sharp, crisp images. Because of the very fine grain and imaging in a thin layer, accurate sharp pictures not obtainable by ordinary diffusers, are obtainable in SPREDLITE.

Wide-angle dispersion due to the unique emulsion and high contrast due to the neutral density light absorbers incorporated in the coating, balance the excessive red of the tungsten filament, thereby giving true color imagery over wide angles. The viewer off at an angle can see the picture as clearly as those directly in front of the screen.

Projection light sources vary considerably to meet the varied requirements of projection equipment. Some projection devices require specialized colors to insure high contrast and resolution for the readout. For this reason you may select a light or dark grey, green or blue SPREDLITE screen for the special purposes of the projection device being designed.

Scales or nameplates can be silk screened onto the SPREDLITE surface, but the preferred method is to silk screen the printing onto the glass or plastic and then coat the surface with SPREDLITE. Greater accuracy because the scale is easier to read results with such contruction. However, the scales and printing must be repetitively printed on a 12" x 12" sheet and subsequently cut to size, rather than coat small pieces which becomes costly. Registration marks

## SPREDLITE REAR PROJECTION SCREENS

are silk screened at the same time as the scales are produced assuring an accurate cutting reference.

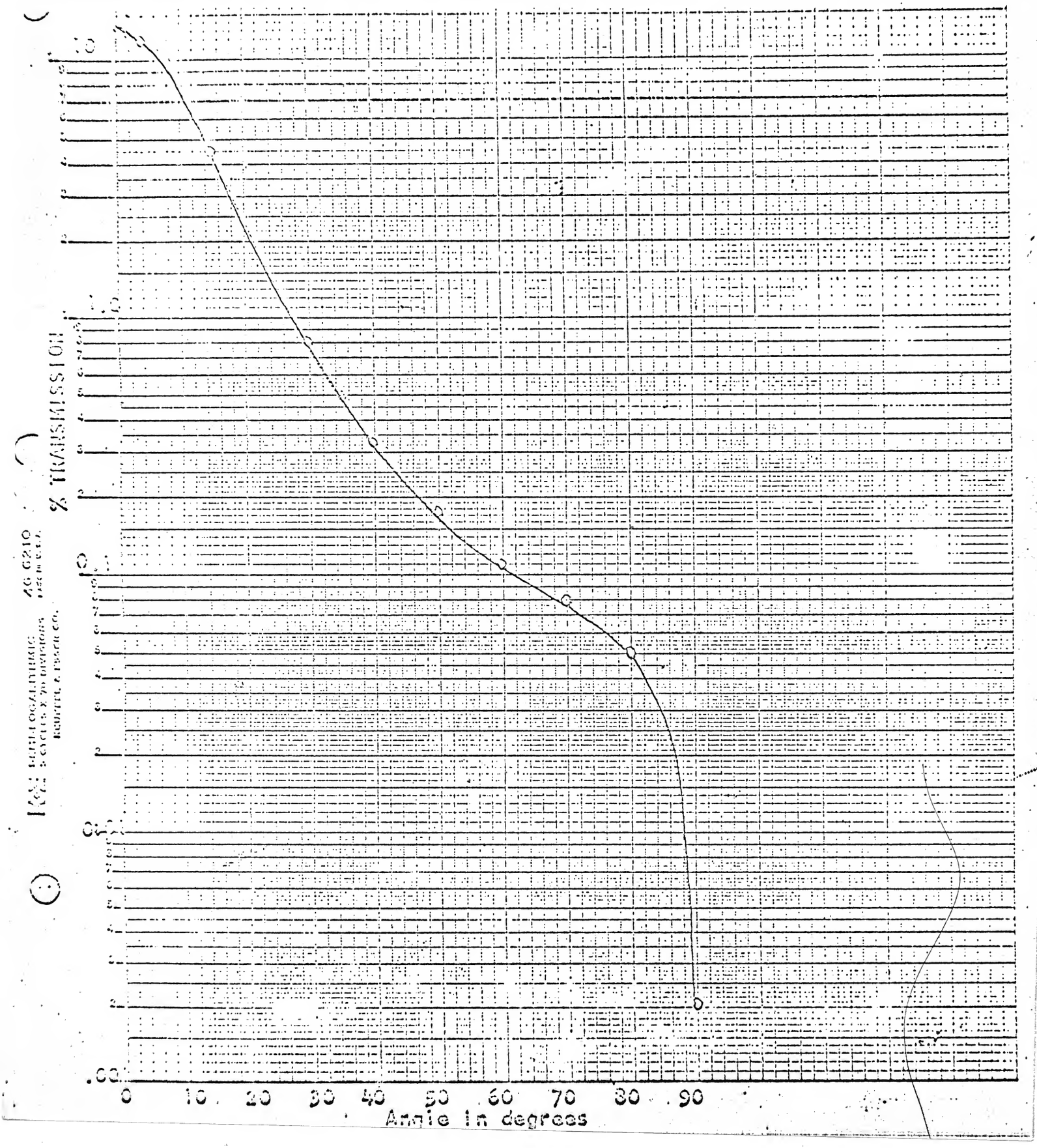
When using the SPREDLITE Screen, the SPREDLITE surface is positioned to face the projection lens leaving a glass or acrylic surface external to the equipment. This should be kept in mind when designing a printed scale because the printing should read correctly in this position.

SPREDLITE Screens are supplied up to 24" x 24" on 1/8" glass or acrylic sheets. Larger panels on 1/4" glass or plexiglas, can be supplied upon request.

SPREDLITE Plexiglas Screens are available in 1/16" and 1/8" thicknesses, and are provided with a non-glare surface, so that the SPREDLITE image is formed internally and the nonglare surface reduces external reflections.

REAR PROJECTION SCREENS

READINGS ARE RELATIVE = MEASUR NTS
TAKEN THREE INCHES FROM PHOTOC



EFFECTIVE NOV. 1, 1968

# SPREDLITE

## PRICE LIST

GLASS OR ACRYLIC SHEET 1/8" THICK
EXTERNAL SURFACES ANTI GLARE COATED

| SIZE CIRCLE or SQUARE | RECTANGLE | LIST PRICE |
|---|---|---|
| 3" | 3" X 4" | $ .60 |
| 5" | 4" X 6" | .96 |
| 7" | 6" X 8" | 1.78 |
| 9" | 8" X 10" | 2.96 |
| 11" | 10" X 12" | 4.40 |
| 13" | 12" X 14" | 5.50 |
| 15" | 14" X 16" | 8.20 |
| 17" | 16" X 18" | 10.60 |
| 19" | 18" X 20" | 13.20 |
| 22" | 20" X 24" | 17.60 |

DISCOUNTS: DEALERS OR MANUFACTURERS

In Lots of 100 or more deduct 50%

Less than 100 Pieces deduct 30%

NON STANDARD SIZES:

We can supply glass in all available thicknesses from 0.040" to 1/8" thickness and acrylic sheet from .040" to 1/8". Compute prices of inbetween sizes to the next larger size listed.

COLORS: LIGHT GREY, DARK GREY, GREEN, BLUE AND WHITE.

# BLACK LIGHT INFROPAKE - Data Sheet

## TYPE I and TYPE II

TYPE I excludes the near blue light and peaks at 360 mmu in the ultra-violet. It is used where visible light leakage is not permissable.

TYPE II transmits some near ultra violet light, peaks at 420 mmu (near blue) but excludes above 475 mmu. Type II is used for fluorescence of pigments for advertising signs and many dyes that will not fluoresce with ultra-violet alone.

1. BLACK LIGHT INFROPAKE is a resin and dye concentrate suitable for flowing, dipping, or knifing. It air dries in one half hour to a tack-free finish. Near ultra-violet is freely transmitted while visible light is excluded. Successive layers will increase the density of the coating, as desired.

2. BLACK LIGHT INFROPAKE should not be used on surfaces that exceed 180 degrees F for short periods of time, and it should not be applied to surfaces that remain over 140°F for prolonged periods.

   Bulbs above 15 watts output may exceed the operating temperature requirements of BLACK LIGHT INFROPAKE. You can, however, coat a glass plate and space the coated glass away from the bulb's immediate contact; in this manner, you can work with higher wattage bulbs.

3. BLACK LIGHT INFROPAKE is basically organic, and its stability is of the order of a stable organic compound. Considerable useage is possible over prolonged periods, providing excess temperatures are not encountered. Operating temperatures above 140°F are not recommended.

4. BLACK LIGHT INFROPAKE will adhere to glass and many other substrates. Some plastic such as plexiglas or cellulose acetate, may require an adhesive interlayer before BLACK LIGHT INFROPAKE is applied to provide for its permanent adhesion. Our adhesive subcoat PM-1 will adhere BLACK LIGHT INFROPAKE to plexiglas and cellulose acetate.

5. BLACK LIGHT INFROPAKE is available as a plastic foil about 0.005" thick in sizes up to 12" x 12" in regular production, and in sizes up to 24" x 24" on special order.

6. BLACK LIGHT INFROPAKE has typical uses such as covers for for fluorescent bulbs, flashlight bulbs, and other low wattage incandescents.

7. BLACK LIGHT INFROPAKE sells for $7.50 per pint, $12.50 per quart, or $22.50 per gallon container. Five gallon drums are sold for $100.00 each, FOB, Whitestone, New York. Each gallon coats approximately 200 square feet. Drum quantities can be supplied at $15.00 per gallon.

8. BLACK LIGHT Plastic Sheets, .005" thick, size 12" x 12" are $5.00 each, or $5.00 per square foot for small orders. Large orders are especially priced.

9. Application of BLACK LIGHT Liquid can be accomplished by dipping your part into the BLACK LIGHT INFROPAKE and then permitting the part to drain until the fluid dries to form a plastic coating in 15 to 30 minutes. Air drying is all that is necessary.

# Instructions for Coating

# BLACK LIGHT INFROPAKE

Type I and Type II Black Light Infropake can be applied to surfaces either by dipping, knifing, brushing or roller application.

Do not attempt to spray Black Light Infropake, as it will form threads in the nozzle and the nozzle will clog.

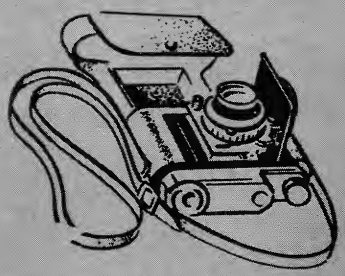
Black Light Infropake can be thinned with Denatured ethyl alcohol (Fotocol or Synasol).

In using Black Light Infropake use with adequate ventillation, keep out of the reach of children. Wash your hands thoroughly with soap and water if your skin comes in contact with the solution.

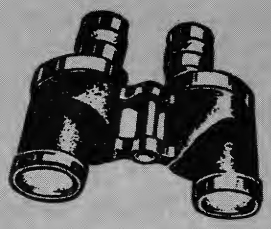
Black Light Infropake plastic should be used as a guide to the finished color of the part you are coating. An envelope with a 2" square patch comes with each can.

# Why POLARIZATION for Industry?

WELDING

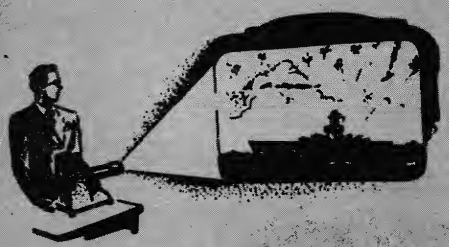


PHOTOGRAPHY



OPTICS

SCIENTIFIC INSTRUMENTS



THREE DIMENSIONAL MOVIES

## ★ POLARIZATION APPLIED TO PRODUCTS

Manufacturers of scientific instruments, photographic equipment, binoculars, telescopes, industrial goggles and many other kindred items find that the added factor of polarization increases the efficiency of their product and contributes to its wider distribution. Where light and sight are involved polarization means larger and better sales.

## ★ POLARIZATION APPLIED TO PRODUCTION

To illustrate but a few of the many industrial applications, polarized products are used in the glass industry to assure proper annealment. Quartz crystal manufacturers consider polarized plates a valuable and money saving tool in determining optical qualities before and after cutting. Polarized products are an integral part of equipment used to determine stresses in all types of structures. Plants using welding equipment, or where harsh light has an effect on the manufacturing process, know the value of polarized helmets, goggles and guard glasses. A glare fatigued worker is not only a bad accident risk but also a poor producer.

## ★ POLARIZATION APPLIED TO YOUR PROBLEM

Locomotives or hair driers, precision instruments, or medical equipment, textiles, processed foods or bottled beverages, whatever your product, Polarization will help you make it, inspect it, and sell it with greater efficiency and economy.

Where "See-ability" is vital—Polarized Products are an industrial must!

## COLOR FILTERS AND POLARIZED FILTERS

Products listed ● are licensed for manufacture and sale under one or more of the following U. S. Patents and others pending:

| | | | | |
|---|---|---|---|---|
| 2104949 | 2226568 | 2398435 | 2479501 | 2543793 |
| 2167899 | 2344514 | 2402176 | 2487063 | 2632725 |
| 2199227 | 2351058 | 2432113 | 2492809 | 2651564 |
| 2220111 | 2354692 | 2453379 | 2519387 | 2670402 |

# MARKS POLARIZED MATERIALS

## TYPE XA - POLARIZED PLASTIC

Polarizing material as a thin foil in a thickness range of 0.0003" to 0.0008" thick is coated on cast cellulose acetate sheet. Present equipment provides a continuous strip of 8" width which is adhered to the cellulose acetate base and is suitable for general purpose commercial sheet polarized use.

The polarized sheet so produced appears neutral grey in color and transmits from 28% to 32% white light. Other transmission ranges are available such as 37-40% white light transmission.

## THICKNESS

Stock is carried in a thickness of .005" although we can process any standard thickness roll type cellulose acetate sheet from 0.005" to 0.020" thickness.

| TYPICAL TRANSMISSION DATA TO WHITE LIGHT | | HIGH TRANS. STOCK |
|---|---|---|
| One Film Only | 28 - 32% | 37 - 40% |
| Two Films Parallel | 18 - 22% | 25 - 30% |
| Two Films Perpendicular | 0.002 - 0.05% | 0.1 - 0.3% |

## TYPE CXR POLARIZERS

There are many uses where a rigid polarizer made on a plastic base is essential. For this purpose we can provide CR-39 sheet or acrylic sheet of various thicknesses coated with our polarizing material.

Acrylic coated polarizers can be obtained in thicknesses from 0.015" to 1/8" and laminated acrylic polarizers can be supplied from .080" to .250". The polarizers have characteristics similar to our TYPE XA as to transmittance and extinction, but this material has greater dimensional stability and resistance to temperature and humidity.

CR-39 polarized films are employed where greater dimensional stability and abrasion resistance is required. All of these plastics can be machined and drilled. The thin acrylics can also be die cut to shape.

## TRANSMITTANCE CHARACTERISTICS

These characteristics are set forth in the accompanying graph as representative of our standard production. However, special transmission ranges and color additives can be made to meet specifications.

## POLARIZED GLASS

Marks polarizers are superior when laminated between glass. The polarizing film is extremely stable and thin. The total lamination thickness is only less than 0.003" thick and after lamination the composite can be surfaced, drilled or edged to any shape and surface desired.

The operating temperature range of these polarizers is from minus 40°F to plus 180°F. Special hard types of laminations can be provided that extend the range on the high temperature side to 250°F for short periods of time.

Good design of optical systems employing polarizers still suggests keeping the polarizer as cool as possible as this prolongs its effective life.

Polarizers are laminated by the Microlam process and are not sensitive to humidity or water immersion for prolonged periods. The polarizers readily meet Military Specifications MIL-F-21424, Grade A, B, and C.

## TYPICAL USES

PRECISION VARIABLE DENSITY DEVICES, SCIENTIFIC INSTRUMENTS, PHOTOGRAPHIC FILTERS, ETC.

# MARKS CIRCULAR POLARIZERS

## CONSTRUCTION

A circular polarizer is obtained by the lamination of a linear polarizer to a quarter wave sheet. Our standard circular polarized sheet can be supplied in a thickness of approximately 0.020" and in sizes, at present, up to 6" square.

## COLORS

The standard circular polarizer normally available is grey. However, yellow, amber, or red circular polarizers are also available. The white lighttransmission through our grey circular polarizer is approximately 32 to 35%. However, the addition of the colors listed reduces the transmission of the assembly, but increases the contrast of the display. Reduction of the reflections encountered on the face of the displays is thereby effectively accomplished.

## USES

Circular polarizers are employed to reduce first surface glare and reflected light from various areas of the room, thereby increasing the visibility, contrast and definition of the display where they are used, such as on instruments, dials, cathode tubes, and other display devices.

## HOW THEY WORK

White light or ordinary unpolarized light in a room passes through the external linear polarizer and thereby becomes linearly polarized. As the linear polarized rays pass through the quarter wave sheet they become out of phase with the linear polarized front surface. Therefore, any light originating in front of the display cannot emerge as an unwanted reflection, as it is absorbed as a result of its inability to travel back through the linear polarizer which is on the external surface.

Low reflection external coatings for the elimination of first surface reflections can be applied if the circular polarizer is laminated in glass.

| THICKNESS OF LAMINATES (presently available) | SIZE |
|---|---|
| Glass - up to 1/4" | Glass - up to 18" x 20" |
| Plexiglass- up to 1/4" | Plexiglass - up to 18" x 20" |

(1) POLARIZED LAMINATED GLASS

Mil-F-21424, Grade A, B, BP and C
Commercial Quality Laminated Polarizers
Ten Second Accuracy or Better Available
All Sizes and Thicknesses

(2) OTHER LAMINATED GLASS POLARIZED PRODUCTS

Polarized Camera Filters
Polarized Color Camera Filters
Polarized Calcite Ring Sights

(3) MICROLAM COLOR FILTERS

Welding Glass Meets Federal Specifications
All Standard Photographic Colors
(UV, Correction Types, N.D.)
Combinations of Interference-Absorption for Unique Transmission

(4) MICROLAM IMPLOSION SHIELDS

Color Safety Laminates
Conductive Interlayers
Circular Polarizers
Low Reflectance External Coating
UV Absorbing Clear Safety Types
Passes Rigid Space Requirements of Altitude and Shock

(5) POLARIZED PLASTIC SHEET

Thin Cellulose Acetate Polarized Sheet
Plexiglass Polarized Sheet
Polarized Photo Print-Out
CR-39 Polarized Sheet
Polarized Transfer Sheet

# POLARIZED PLASTIC PRICE LIST

## Prices Effective Oct. 11, 1967

The linear polarizers which we supply are made by bonding first quality Marks Polarized Corporation film to a standard plastic sheet. The sheets we employ may be either Cellulose Acetate, Cellulose Acetate Butyrate, Vinyl Chloride Acetate, Acrylic, or CR-39, depending on the end use.

Our Engineering Department will be happy to recommend the approximate carrier sheet for your end use. Unless specified otherwise, our standard sheets will be shipped.

Transmissions which are available (White Light transmission):

22, 32, 35, 38, 40-45%

Stocks are carried in 32, 35%.

See attached graph for transmission versus wavelength characteristics.

| Size | Thickness | Base Material | Price |
|---|---|---|---|
| 8" x 10" | .005" | Cast Cellulose Acetate | $ 2.50 Each |
| 8" x 12" | .005" | Cast Cellulose Acetate | $ 2.75 Each |
| 8" x 12" | .010" | Cast Cellulose Acetate | $ 2.75 Each |
| 8" x 10" | .030" | Press Polished Acetate | $ 3.00 Each |
| 18" x 18" | .010" | Cast Cellulose Acetate | $ 8.75 Each |
| 18" x 18" | .015" | Vinyl Chloride Acetate | $ 9.00 Each |
| 18" x 18" | .030" | Vinyl Chloride Acetate | $10.00 Each |
| 18" x 18" | .040-.060" | Plexiglas(Optical quality) | $17.50 Each |

Circular Polarizers

We can supply circular polarizers in grey or amber. We supply either .020" or .030" thick sheets in sizes up to 18" x 18", but .030" is made on special order only.

| Size | Thickness | Price on Grey | Price on Amber |
|---|---|---|---|
| 8" x 10" | .020" | $ 5.00 Each | $ 5.50 Each |
| 10" x 12" | .020" | $ 7.50 Each | $ 8.00 Each |
| 12" x 18" | .020" | $ 9.00 Each | $ 9.50 Each |
| 18" x 18" | .020 | $15.00 Each | $15.50 Each |

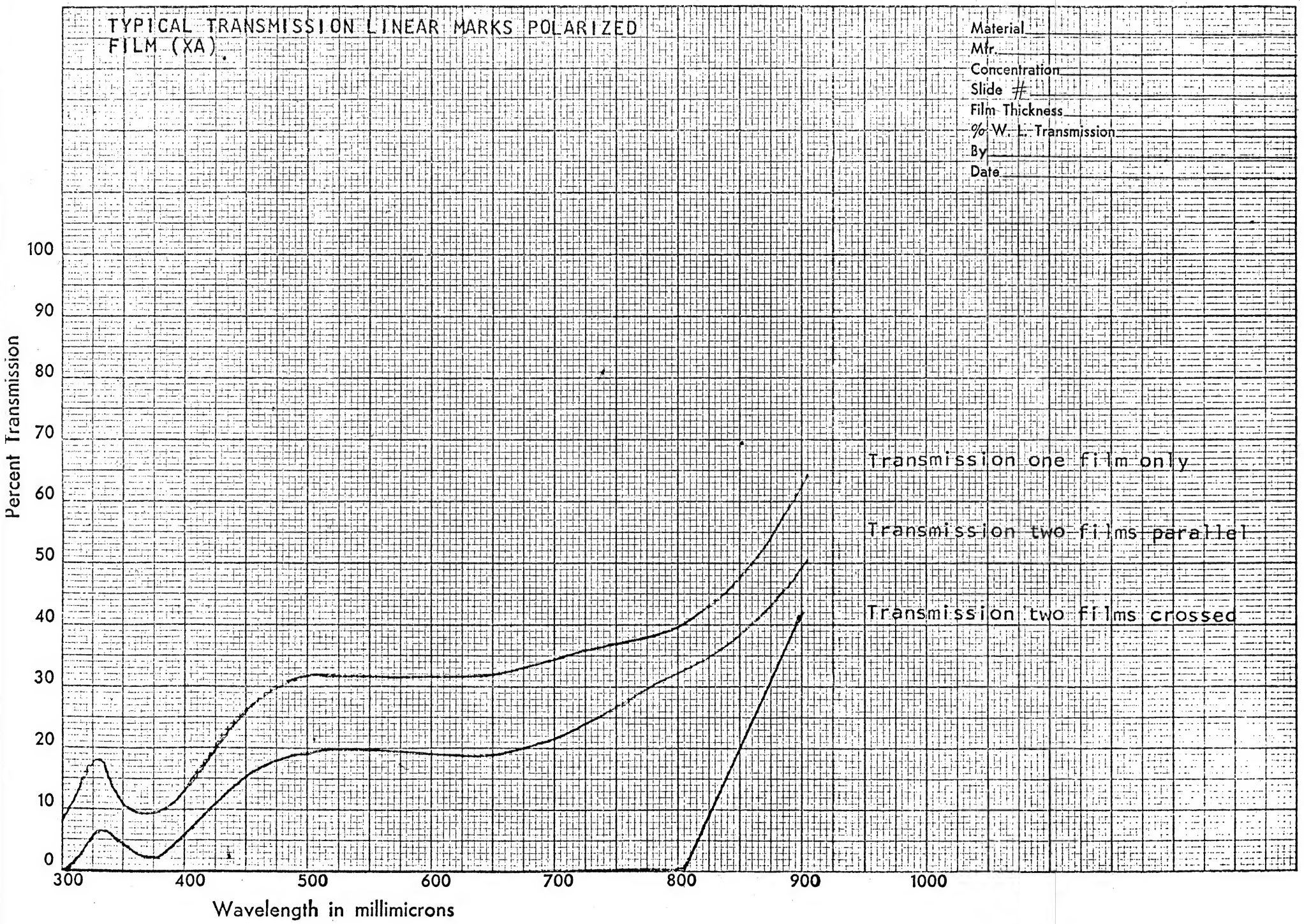
NOTE: All of the above prices are FOB, Whitestone, New York. Packaging costs are included except crating for overseas shipment. Substantial savings are made when quantities are ordered. Please apply for our latest quantity quotations.

K&E 10 X 10 TO THE ½ INCH KEUFFEL & ESSER CO. ALBANENE 359T-11G MADE IN U.S.A.

Marks Polarized Corporation - Whitestone, L. I.

# TYPICAL TRANSMISSION LINEAR MARKS POLARIZED FILM (XA).

Material
Mfr.
Concentration
Slide #
Film Thickness
% W. L. Transmission
By
Date



# MANUFACTURERS! MARKS

# LAMINATED COLOR FILTERS AND POLARIZED FILTERS now available

CONTINUOUS CRYSTALLINE FILMS PATENTED

Section of ordinary lamination Scale 10:1

**NOTE: THICK SOFT CORE**

Section of **MICROLAM***

**NOTE: PRECISION-THIN JOINT**

## Standard 10"x10" Panels . . any thickness . . any color specification

Ultraviolet
Infrared
Blue
Yellow
Violet
Green
Orange
Red

} in all shades and densities

**YOU CAN CUT, EDGE, DRILL AND POLISH THESE SHEETS TO YOUR REQUIREMENTS—**

## MICROLAM*

*The new precision-thin lamination*

**TESTED AND APPROVED BY**

- U. S. Army Laboratories
- U. S. Navy Laboratories
- U. S. Air Force Laboratories

- **PERFECTION OF IMAGE TRANSMISSION**

In ordinary laminations, which are .010 to .015" thick, undulations, variations in density, and variations in refractive index all contribute to image distortion. Microlam* is precision-thin, only .0015" thick, and is homogeneous in composition and thickness from glass surface to surface, hence images are transmitted therethru with utmost perfection.

- **LAMINATION QUALITY**

Most plastic media have imperfections such as striae, dirt particles, etc., which are more noticeable in proportion to the thickness of the film. Since Microlam* is about 1/10th the thickness of ordinary laminations imperfections are reduced by the same proportion.

- **CONSTANT THICKNESS**

*Prism Deviation Minimized*

In assembling precision optical units a variation in the thickness of the lamination will introduce "prism." In Microlam* laminations two factors cooperate to minimize and substantially reduce prismatic errors in lamination. Microlam* laminations are only 1/10th the thickness of ordinary laminations, and the method of manufacture assures the utmost uniformity within that thickness, hence any errors are confined to minor variations of an already small quantity: thickness.

- **MICROLAM* GROUND AND POLISHED** *are Super Precision*

Microlam* laminations when ground and polished are exceptionally stable dimensionally. The ordinary thick plastic lamination produces "gives" under the various forces in grinding and polishing so that it is difficult to surface such lenses to permanent form. As soon as they are released from the polishing block these lenses spring out of shape. Microlam* microlaminations, however, are so thin and substantially solid, though slightly resilient, that any error introduced by tendency to "give" under grinding and polishing forces are reduced to about 1/10th that of the ordinary lamination. Hence precision grinding and polishing to 1-2 seconds, and a few wavelengths flatness are readily obtained.

- **HIGH ADHESION — JOINT**

Lamination strength is constant from −70 degree to 180 degree Fahrenheit. Also will not bubble, crack or warp under these extreme conditions.

- **IMPERVIOUS TO WATER**

Microlam* laminations are impervious to pure or seawater, and can be edged, ground and polished without separation.

- **SHEET GLASS LAMINATIONS**

Microlam* laminations are made with select quality sheet glass. Without grinding and polishing, unusually good performance is being obtained; for example ½ to 1 minute deviation or less is usual; whereas, it is difficult in the ordinary lamination to maintain a prism deviation of 3-4 minutes, without grinding and polishing.

Products listed below are licensed for manufacture and sale under one or more of the following U. S. Patents and others pending:

| | | | |
|---|---|---|---|
| 2,432,113 | 2,492,809 | 2,651,564 | 2,897,544 |
| 2,453,379 | 2,519,387 | 2,670,402 | 2,952,182 |
| 2,479,501 | 2,543,793 | 2,810,324 | 2,961,486 |
| 2,487,063 | 2,632,725 | 2,887,566 | 2,006,241 |

**Marks Polarizing Plates***
Polarizers
for all purposes

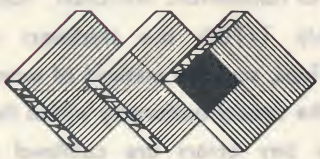
The Marks Polarizing Plates are the "ORIGINAL" Polarized Product; the first offered for sale anywhere in the world. Over the years they have been increasingly perfected until today they are the finest polarizer obtainable.

**Microlam***
Clear and Color
Laminations

**PHOTOGRAPHY**

**SCIENTIFIC INSTRUMENTS THREE DIMENSIONAL MOVIES OPTICS**

*Inquires invited . . .*



**MARKS POLARIZED CORPORATION**

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